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(54) **HIGH DENSITY VERTICAL NANOWIRE  
STACK FOR FIELD EFFECT TRANSISTOR**

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**H01L 29/1033** (2013.01); **H01L 29/42376**  
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See application file for complete search history.

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(57) **ABSTRACT**

An alternating stack of layers of a first epitaxial semicon-  
ductor material and a second epitaxial semiconductor materi-  
al is formed on a substrate. A fin stack is formed by  
patterning the alternating stack into a shape of a fin having  
a parallel pair of vertical sidewalls. After formation of a  
disposable gate structure and an optional gate spacer, raised  
active regions can be formed on end portions of the fin stack.  
A planarization dielectric layer is formed, and the disposable  
gate structure is subsequently removed to form a gate cavity.  
A crystallographic etch is performed on the first epitaxial  
semiconductor material to form vertically separated pairs of  
an upright triangular semiconductor nanowire and an  
inverted triangular semiconductor nanowire. Portions of the  
epitaxial disposable material are subsequently removed.  
After an optional anneal, the gate cavity is filled with a gate  
dielectric and a gate electrode to form a field effect transistor.

**9 Claims, 12 Drawing Sheets**

